

Descriptions of Potential BDCP Conservation Strategy Options

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1.0 Introduction

As part of the Bay-Delta Conservation Plan (BDCP) process, a Conservation Strategy (CS) is being developed that, when implemented, would conserve Covered Species of fish and other components of the Delta ecosystem. The planning process to date has generated four potential CS Options based on existing scientific information about environmental stressors affecting covered fish species and Delta ecosystem processes.

This document provides a description of the facilities, operations, and habitat restoration elements of the four CS Options developed by the Conservation Strategy Workgroup. These options are recommended by the Workgroup to the Steering Committee for approval to further evaluate their feasibility and effectiveness in conserving the Covered Species and other components of the ecosystem.

The four options are described herein with summary descriptions of the conveyance facilities and operations elements that define them, as well as potential associated habitat restoration and enhancement opportunities. Maps are provided to graphically illustrate the key components of each option. There are a number of restoration elements that could be applied under any or all of the options; these elements are identified separately in the last section of this document.

The CS Options recommended to the Steering Committee are:

- **Option 1.** Existing pumping and associated facilities would be used, potentially including opportunistic water pumping and export during high flows (i.e., drawing water at times that have the least adverse affects for covered fish species). Restoration opportunities would be primarily in the northern and western Delta.
- **Option 2.** Operable physical channel barriers, siphons, and a hydraulic inter-tie would be constructed in the southern Delta to create flow corridors separating fish from pumping facilities in Old, Middle and San Joaquin Rivers. Restoration opportunities would include those identified in Option 1 plus additional opportunities in the central and south Delta.
- **Option 3.** The facilities alterations under this option would include those identified in Option 2, plus a new intake facility on the Sacramento River with a state-of-the-art positive barrier fish screen and isolated conveyance directly to SWP/CVP facilities in the south Delta. Existing pumping and intake facilities could still be operated in lieu of or in addition to the new facilities. Habitat restoration and enhance would be similar to that under Option 2. Fluctuating salinity conditions could also be implemented by operations of the new facilities.
- **Option 4.** All SWP and CVP diversions would occur at a new facility on the Sacramento River with a state-of-the-art positive barrier fish screen and water would be conveyed via a peripheral aqueduct with the SWP/CVP facilities fully isolated from the Delta. Opportunities for habitat restoration and enhancement under Option 4 could be applied Delta-wide. Fluctuating salinity conditions could be implemented with the greatest flexibility and extent of the four options.

These four CS Options focus on water operations, conveyance, and habitat restoration conservation elements. Additional conservation elements, such as the elements described in section 4.0 *Potential Additional/Common Elements*, are expected to be added to one or more of the options during the process of conservation strategy development. The four options presented here provide alternate foundations for a conservation strategy. The process of developing the BDCP conservation strategy is iterative and staged: the CS Options will be evaluated to assess their relative benefits to covered species and ecosystem functions, some elements of these options will be carried forward, additional elements addressing specific environmental stressors may be added, and more detail will be provided for all elements of the strategy that is carried forward. Through this process, the goal is to arrive at a single conservation strategy framework by the end of 2007 and then to further develop that conservation strategy with specific and well described conservation measures and actions by the end of 2008. Throughout this process of building a conservation strategy, input from Fishery Agencies, stakeholders, independent scientists, and the public have and will support the crafting of the overall approach and individual conservation elements that eventually will constitute the conservation strategy.

The next step in the process is a comparative evaluation of the four CS Options to assess their relative effectiveness in the conservation of covered fish species and ecosystem functions. The proposed approach to this analysis will be developed and reviewed by the CS Workgroup and Steering Committee prior to its conduct. It is anticipated that additional refinement of the operational elements of the options will be completed for the evaluation and that the evaluation will include a hydrodynamic assessment of each option.

2.0 Approach to Identifying Habitat Restoration and Enhancement Opportunities

As part of the BDCP development process, potential habitat restoration and enhancement opportunities were identified that would benefit covered fish species, including Federally- and State-listed Threatened and Endangered fish, as well as other components of the aquatic ecosystem. Potential locations for habitat restoration and enhancement in and around the BDCP Planning Area are identified in Figure 1. The types of habitat features that would be most beneficial to various fish species and other native aquatic organisms vary depending on a number of factors that include:

- Hydrodynamic characteristics of channels within the Delta that reflect differences in water conveyance facilities associated with the SWP and CVP export facilities;
- Geographic location within the Delta with respect to various existing habitat conditions such as interconnections among channels, elevation, and existing habitat conditions; and
- Variation in salinity occurring within Suisun Bay and the western Delta in association with various water conveyance facilities, future water management decisions, and water quality regulations and requirements for protecting other water users within the Delta.

Consideration was given to identifying potential high function habitat restoration and enhancement opportunities in the Delta with respect to each option's water conveyance method:

- Option 1: Continued conveyance using the existing Delta channels in combination with export operations of the SWP and CVP facilities that draw water at times with the least adverse affects on covered fish species.
- Option 2: Construction and operation of a series of barriers designed to separate hydrodynamic conditions between Old River and Middle River to accomplish greater hydraulic residence time and improve habitat conditions within Old River and portions of the western-central Delta while using the Middle River channels as the primary water conveyance facilities to the existing SWP and CVP export facilities.
- Option 3: A dual conveyance facility that would incorporate alternative operations using either Middle River as a conveyance facility as described in Option 2 and/or an isolated conveyance facility equipped with a positive barrier fish screen located on the Sacramento River in the vicinity of Hood or Clarksburg.
- Option 4: A fully isolated facility for conveying water from a point of diversion on the Sacramento River at Hood or Clarksburg, equipped with a state-of-the-art positive barrier fish screen, to the SWP and CVP export facilities.

Each of these conveyance facilities options and operational strategies affect the hydrodynamic conditions within the Delta in different ways. Anticipated (qualitative) changes in hydrodynamics within the Delta channels under each of the conveyance options were taken into consideration when identifying potential opportunities and the geographic distribution of high-value habitat restoration and enhancement. No specific decisions have yet been made regarding changes in hydrodynamics or the specific location or extent of a habitat restoration and enhancement actions for each option.

The habitat restoration and enhancement measures identified in this document are not intended to reflect requirements of mitigation of incidental take as a result of BDCP Covered Activities, but rather represent the range of potential habitat restoration and enhancement actions that could produce benefits to covered fish species under the range of conveyance facilities options. The habitat restoration and enhancement actions are not intended to represent a commitment or recommendation for a specific set of actions to be included in one or more of the Conservation Strategies but should be viewed as an initial list of potential opportunities to provide biological benefits within the context of each of the four alternative conveyance options identified by the Workgroup. The habitat restoration and enhancement measures identified below should be considered a preliminary pallet of opportunities for inclusion in the overall conservation strategy. Habitat restoration and enhancement measures would be developed under each conservation strategy option within the constraints and opportunities provided by the alternative conveyance facilities and SWP and CVP operations.

The purpose of this document is to identify the potential geographic range and types of habitat restoration and enhancement actions that may be most compatible with various alternative water conveyance facilities. Figure 1 provides an illustration of locations of potential habitat restoration and enhancement opportunity areas that could be used for the benefit of covered fish species under all of the CS Options. The range of habitat restoration and enhancement opportunities identified here is not comprehensive, and additional opportunities are likely to be identified during the BDCP planning process. BDCP habitat restoration and enhancement opportunities are not limited to the range of actions identified in this document. Restoration and enhancement opportunities provided herein are intended to be used as a starting point for discussion of alternative Conservation Strategies within the range of opportunities that one or more of the conveyance options supports.

2.1 Habitat Attributes (Desired Benefits)

During the process of identifying potential habitat restoration and enhancement opportunities, consideration was given to the ability of habitat modifications to achieve various desirable habitat attributes. These habitat attributes include, but are not limited to, the following:

- Improving connectivity among desirable habitats within the Delta;

- Improving the quality and availability of spawning and juvenile rearing habitat;
- Improving the quality and availability of suitable foraging habitat for juvenile and adult fish;
- Improving the production of organic carbon, phytoplankton, and zooplankton available within the Delta as a food resource for fish and other aquatic resources;
- Increasing hydraulic residence time within the Delta to improve habitat quality and availability for various covered fish species as well as to contribute to increased production of zooplankton and other food resources for the aquatic ecosystem;
- Maintaining net westerly flows within Delta channels to achieve natural hydrodynamic conditions, to the extent practicable; and
- Improving migration pathways for both upstream and downstream fish movement that serve to reduce vulnerability to various potential sources of mortality and provide increased access to habitat for spawning, egg incubation, and juvenile rearing.

Using the habitat attributes various alternative opportunities for habitat restoration and enhancement actions were identified based on consideration both of geographic regions within the Delta as well as the four alternative water conveyance systems identified in the CS Options.

2.2 Types of Potential Habitat Restoration and Enhancement Measures

A range of potential opportunities were identified using information from surveys conducted by California Department of Fish and Game (DFG) and others for consideration as part of the CS Options. For example, various types of habitat restoration and enhancement actions included for consideration would:

- Increase abundance and extent of brackish water tidal wetlands;
- Increase abundance and extent of freshwater tidal wetlands;
- Improve quality and quantity of suitable spawning gravels;
- Increase access to seasonal floodplains through actions such as setting back levees, selective flooding of islands, increasing the frequency and duration of access to flood control bypasses, etc.;

- Preserve upland habitat (i.e., a corridor between the western Delta and Suisun Marsh); and
- Improve channel configuration for flows and for upstream and downstream fish passage.

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3.0 Conservation Strategy Option Descriptions

3.1 Conservation Strategy Option 1

Option 1 would involve the use of existing conveyance and pump facilities with operations focused on reducing take at the export facilities and improvement of hydrologic conditions for fish in the northern and western Delta; physical habitat restoration would be focused in the north and west Delta and Suisun Marsh (Figure 2)

3.1.1 Facilities

This option would use the existing export facilities (Tracy and Harvey O. Banks Delta Pumping Plants) in the South Delta near Clifton Court Forebay.

3.1.2 Water Operations

[Text under development]

3.1.3 Habitat Restoration and Enhancement

Based on anticipated hydrodynamic conditions within Delta channels associated with opportunistic exports from the existing SWP and CVP export facilities, opportunities for habitat restoration and enhancement have been primarily identified within the northern and western regions of the Delta (Figure 2). Although opportunistic exports would not preclude habitat restoration and enhancement within the central or southern Delta, potential biological benefits are anticipated to be lower due to increased water velocities and reduced residence time, as well as increased vulnerability to entrainment at SWP and CVP export facilities, when compared to enhanced habitat located further away from the potential zone of export influence. Potential habitat restoration and enhancement opportunities identified in association with conveyance Option 1 would include:

- Increasing spawning habitat for salmon and steelhead within the upstream reaches of the mainstem Sacramento River and major tributaries through enhanced quantity and quality of spawning gravels (gravel augmentation and/or cleaning).
- Providing access to seasonally inundated floodplain habitat for splittail spawning and foraging habitat for juvenile Chinook salmon, steelhead, and other resident and migratory fish and increasing the contribution of nutrients and organic carbon produced within floodplain habitat to the Delta. This would be accomplished by modifying the existing channel configuration and levees on the mainstem of the Sacramento River to increase the frequency and duration of seasonal floodplain inundation over a wider range of flow conditions than currently exists.

- Providing an alternative migration route for Chinook salmon, steelhead, and other resident and migratory fish within the northern region of the Delta, which would bypass the Delta cross channel and Georgiana Slough. Passage of fish from the Sacramento River into the interior Delta has been identified as a source of increased mortality for juvenile Chinook salmon. The alternative migration pathway could be accomplished by enhancing the channel configuration and hydraulics. Improved migration through sloughs and channels may require additional structures within the river to help guide migrating fish into connecting waterways .
- Increasing habitat diversity and complexity for delta smelt and other resident fish species within the northern Delta as well as increasing organic carbon production, phytoplankton, and zooplankton production that are important food resources for delta smelt and other fish species inhabiting the Delta by enhancing the area of freshwater tidal wetlands.
- Improving hydraulic residence time and tidal exchange within sloughs and channels to contribute organic carbon, nutrients, phytoplankton, and zooplankton production to the Delta food web. Evaluate the potential influence of export operations to the North Bay Aqueduct from the Barker Slough pumping plant on tidal hydrodynamics, hydraulic residence time, and organic production within the Delta and relocate or modify the Barker Slough pumping plant, as needed.
- Providing connectivity between high-value habitat within the northern region of the Delta and Suisun Marsh for wildlife movement as well as preserving important terrestrial habitat by securing a wildlife corridor.
- Increasing the availability of brackish and freshwater tidal habitat in Suisun Marsh, including dendritic channels within both intertidal and subtidal areas, to increase habitat diversity and quality and availability of habitat for delta smelt and other fish species inhabiting Suisun Marsh. The increase in intertidal and subtidal habitat with freshwater and brackish marsh vegetation would also contribute to increased production of organic carbon, phytoplankton, and zooplankton (important components of the food web) immediately adjacent to important larval and juvenile rearing habitat within the marsh and Suisun Bay for a large number of fish species and other aquatic resources. This could be accomplished by reconfiguring levees and water management along the channel margins adjacent to Suisun Bay as well as along interior channels.
- Protecting and promoting enhancements to tidal wetlands within the area adjacent to Sherman Lake to increase habitat diversity and complexity for delta smelt and other fish species, improve juvenile and adult foraging habitat, and improve production of organic carbon, phytoplankton, and zooplankton within Suisun Bay area.

- Constructing interior levees, reestablishing tidal inundation, and promoting tidal wetland development within the western portion of the Delta and Suisun Bay to increase habitat diversity and complexity for delta smelt and other fish species, improve juvenile and adult foraging habitat, and improve production of organic carbon, phytoplankton, and zooplankton within Suisun Bay area.
- Constructing interior levees to allow tidal inundation along channel margins of the lower Sacramento River to increase habitat diversity and complexity for delta smelt and other fish species, improve juvenile and adult foraging habitat, and improve production of organic carbon, phytoplankton, and zooplankton within the lower Sacramento River and Suisun Bay area.
- Providing setback levees and other modifications to the channel adjacent to Suisun Bay and the lower Sacramento River to allow tidal inundation and promote tidal wetland vegetation colonization, which would increase habitat diversity and complexity for delta smelt and other fish species, improve juvenile and adult foraging habitat, and improve production of organic carbon, phytoplankton, and zooplankton within the lower Sacramento River and Suisun Bay area.
- Reducing the vulnerability of juvenile and adult fish to predation and pre-screen losses within Clifton Court Forebay by implementing a management program that may include actions such as predator removal, modification of radial gate operations, and adding facilities to promote passage from the radial gate to the salvage facility.
- Increasing the survival and reducing stress on fish salvaged at both the SWP and CVP salvage facilities by improving the collection, handling, transport, and release facilities and procedures.

Under Option 1, opportunities to achieve variable salinity conditions would primarily be limited to the region located west of the confluence between the Sacramento and San Joaquin rivers.

3.1.4 Additional Conservation Elements

[Text to come as additional elements added]

3.2 Conservation Strategy Option 2

Option 2 would involve improvement of through-Delta conveyance by constructing operable barriers and levee improvements along Middle River and separating water supply conveyance flows from San Joaquin River flows with a siphon connecting Victoria Canal and Clifton Court Forebay; operations focused on reducing take at the export facilities and improvement of hydrologic conditions for fish in the northern, western, central, and southern Delta; and physical habitat restoration focused in the north, west, central, and south Delta and Suisun Marsh (Figure 3).

3.2.1 Facilities

The proposed new facilities considered under the Option 2 scenario include the following:

- Operable physical channel barriers near the confluence of Middle River and the following channels:
 - Woodward Canal;
 - Railroad Cut; and
 - Connection Slough.
- Operable physical channel barrier near the confluence of Old River and the San Joaquin River.
- Siphon Old River under Middle River hydraulically connecting Victoria Canal with Clifton Court Forebay in the south Delta.
- Hydraulic intertie between Clifton Court Forebay and the CVP intake channel in the south Delta.

3.2.2 Water Operations

[Text under development]

3.2.3 Habitat Restoration and Enhancement

Based on a consideration of the tidal hydrodynamics that would be anticipated to occur within the Delta under Option 2, all of the habitat restoration and enhancement opportunities identified under Option 1 would be available. Under Option 2, opportunities for habitat restoration and enhancement would be expanded to include the central and southern regions of the Delta as shown in Figure 3. In addition, under Option 2, a siphon would be used to convey water from Middle River to the export facilities without obstructing the Old River channel. The siphon would provide habitat restoration and enhancement opportunities within the San Joaquin River bypass and mainstem San Joaquin River (Figure 3). In addition to the features identified in Option 1, additional habitat enhancement may include:

- Increasing habitat diversity and complexity, providing additional habitat for foraging by juvenile and adult fish, and increasing production of organic

carbon, phytoplankton, and zooplankton within the central and southern Delta. This would be accomplished by increasing the availability of tidally inundated shallow-water wetland habitat, through set back levees or creation of additional berms, associated with virtually all of the channels located between the barriers on Middle River and the Antioch Bridge (Figure 3). Primary and secondary production within the habitats adjacent to Old River would be improved under Option 2 as a result of the increase in hydraulic residence time resulting from placement and operations of the hydraulic barriers; and

- Increasing the availability of shallow-water habitat for juvenile rearing and foraging, increasing floodplain habitat available for splittail spawning, increasing habitat diversity and complexity, improving the migration corridor for Chinook salmon and other fish species migrating into the San Joaquin River basin, and improving habitat conditions and foraging opportunities for juvenile salmonids emigrating from the San Joaquin River. This would be accomplished by increasing the availability of seasonal floodplain habitat inundation as well as tidal inundation along channels located in the southern Delta . As a result of the siphon located on Middle River, increased production of organic material, phytoplankton, zooplankton, and nutrients from the San Joaquin River basin would be able to flow downstream and further benefit trophic dynamics within the enhanced habitat adjacent to Old River as well as further downstream within Suisun Marsh.

Under Option 2, opportunities to achieve variable salinity conditions (based on SWP and CVP export water quality only) would be limited to the region located west of Middle River (Figure 3).

3.2.4 Additional Conservation Elements

[Text to come as additional elements added]

3.3 Conservation Strategy Option 3

Option 3 would involve dual conveyance facilities and physical and operational habitat restoration and enhancement. Conveyance would be via: (1) a peripheral aqueduct with an intake on the Sacramento River and isolated connection at the SWP/CVP pump facilities; and (2) an improved through-Delta conveyance with operable barriers along Middle River and separated water supply flows from San Joaquin River flows by a siphon. Operations would focus on the use of the flexibility of dual conveyances to reduce take of covered fish species at the export facilities and improve of hydrologic conditions for covered fish in the northern, western, central, and southern Delta. Physical habitat restoration and enhancement would be focused in the north, west, central, and south Delta and Suisun Marsh (Figure 4).

3.3.1 Facilities

The proposed new facilities considered under Option 3 include the following:

- Operable physical channel barriers near the confluence of Middle River the following channels:
 - Woodward Canal;
 - Railroad Cut; and
 - Connection Slough.
- Operable physical channel barrier near the confluence of Old River and the San Joaquin River.
- Siphon Old River under Middle River hydraulically connecting Victoria Canal with Clifton Court Forebay in the South Delta.
- Intake facility with fish screens on the Sacramento River at either Hood or Clarksburg.
- Conveyance canal and associated appurtenant facilities (i.e., pumping plant and siphons) that would traverse from the new Intake Facility along the Sacramento River southerly along an alignment in the East Delta adjacent to and west of Interstate 5. The conveyance canal would terminate south of Clifton Court Forebay and tie into the existing SWP and CVP Project facilities.
- Under this option, the existing export facilities (Tracy and Harvey O. Banks Delta Pumping Plants) in the South Delta near Clifton Court Forebay may be utilized in addition to the new Intake facility on the north Sacramento River.

3.3.2 Water Operations

[Text under development]

3.3.3 Habitat Restoration and Enhancement

Since the dual facility would continue to use the Middle River corridor for water conveyance in addition to diversion from the Sacramento River via an isolated facility, the hydrodynamic conditions occurring within the Delta are expected to be within the range of Options 2 and 4 depending on the specific characteristics of conveyance operations. As a result of these conditions, habitat restoration and enhancement opportunities under Option 3 (Figure 4) are anticipated to be comparable to habitat opportunities identified and described for conveyance Option 2 (Figure 3). To the extent that water exported by the SWP and CVP occurs almost exclusively from a state-of-the-art positive barrier fish screen located on the Sacramento River at Hood or Clarksburg, additional habitat restoration and enhancement opportunities would also occur within areas of the northern Delta and eastern Delta tributaries and sloughs. As a result of the uncertainties regarding dual facility operations, the primary focus on habitat restoration and enhancement opportunities under Option 3 would be in the northern and western portions of the Delta and central and southern Delta channels located to the west of the barriers on Middle River (Figure 4).

Under Option 3, opportunities for variable salinity conditions (based on SWP and CVP export water quality only) would be limited to the region located west of Middle River (Figure 4).

3.3.4 Additional Conservation Elements

[Text to come as additional elements added]

3.4 Conservation Strategy Option 4

Option 4 would involve construction of a peripheral aqueduct with an intake on the Sacramento River and isolated connection at the SWP/CVP pump facilities. Operations would provide the flexibility to improve hydrologic conditions for covered fish species throughout the Delta and to physically restore and enhance habitat opportunistically throughout the Delta and Suisun Marsh (Figure 5).

3.4.1 Facilities

The proposed new facilities considered under Option 4 include the following:

- Intake facility with state-of-the-art positive barrier fish screens on the Sacramento River located upstream of Rio Vista.
- Conveyance canal and associated appurtenant facilities (i.e., pumping plant and siphons) that would traverse from the new Intake Facility along the Sacramento River southerly along an alignment in the East Delta adjacent to and west of Interstate 5. The conveyance canal would terminate south of Clifton Court Forebay and tie into the existing SWP and CVP Project facilities.

3.4.2 Water Operations

[Text under development]

3.4.3 Habitat Restoration and Enhancement

Under Option 4, all of the SWP and CVP exports would occur through a state-of-the-art positive barrier fish screen located on the Sacramento River near Hood or Clarksburg. Hydrodynamic conditions within the Delta would be expected to have a net westerly flow, restoring more natural Delta conditions (Figure 5). Under the export and Delta hydrologic conditions expected to occur under Option 4, opportunities for habitat restoration and enhancement would be expanded to the entire Delta (Figure 5). Habitat restoration and enhancement opportunities under Option 4 would include all opportunities identified under Options 1, 2, and 3. Additionally, Option 4 would support opportunities to create floodplain, seasonal bypasses, corridors for migration, and shallow water tidally inundated wetland areas extended geographically eastward to approximately Interstate 5. Under Option 4, there would be no need for the improvements designed to reduce predation mortality within Clifton Court Forebay and in the collection, handling, transport, and release of fish salvaged at the export facilities, as described in the other options.

Under Option 4, opportunities to achieve variable salinity conditions (based on SWP and CVP export water quality only) would occur throughout the Delta extending eastward to approximately Interstate 5 (Figure 5).

3.4.4 Additional Conservation Elements

[Text to come as additional elements added]

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4.0 Potential Additional/Common Conservation Elements

Modifications to water conveyance facilities and habitat restoration and enhancement opportunities, including Delta hydrodynamics, described for Options 1-4 primarily address stressors associated with direct entrainment losses at the SWP and CVP export facilities, indirect mortality associated with fish passage into the central and southern Delta, aquatic habitat diversity, quality, quantity, and complexity, increased salmon spawning and juvenile rearing areas, and opportunities for increased production of organic carbon, phytoplankton, and zooplankton as part of the food web of the Delta ecosystem. A number of additional stressors have been identified that are not addressed by the habitat related actions identified above that may significantly impact the population dynamics of one or more of the covered fish species inhabiting the Delta. Additional conservation elements have been identified that could be applied to any of the four options to address these additional stressors. These conservation elements and other actions and opportunities could be implemented at various levels to further supplement biological benefits associated with alternative conveyance facilities and habitat restoration and enhancement opportunities described for Options 1-4.

The additional conservation elements that could be applied to any of the options include:

- Reduce the risk of acute and chronic toxicity to fish, macroinvertebrates, phytoplankton, and zooplankton throughout the Delta by reducing and avoiding point and non-point source discharges of toxicants and contaminants into the Delta and its tributaries.
- Reduce the risk of acute and chronic effects to fish, macroinvertebrates, phytoplankton, and zooplankton throughout the Delta by reducing and avoiding localized adverse water quality conditions, such as dissolved oxygen depression within the Stockton deep water ship channel and associated with managed wetland discharges.
- Reduce and avoid adverse impacts of non-native species on native species (e.g., competition for habitat and food, predation, changes in physical habitat, etc.) throughout the Delta by implementing management actions designed to reduce and avoid the introduction of additional non-native aquatic species into the Delta ecosystem.
- Reduce adverse impacts of non-native species on native species (e.g., competition for habitat and food, predation, changes in physical habitat, etc.) throughout the Delta by implementing and expanding activities designed to reduce or control the abundance or distribution of non-native species currently inhabiting the Delta.
- Reduce the effects of harvest mortality on juvenile and adult fish to increase population abundance and resiliency and to take advantage of habitat restoration and enhancement opportunities in re-building fish stocks by

modifying recreational and commercial fishing regulations within the ocean and Delta.

- Reduce the effects of illegal harvest mortality (poaching) on juvenile and adult fish to increase population abundance and resiliency and to take advantage of habitat enhancement opportunities in re-building fish stocks by increased enforcement and prosecution of regulations prohibiting illegal harvest and poaching.
- Reduce entrainment mortality of larval and juvenile fish and macroinvertebrates at unscreened agricultural, municipal, and industrial water diversions located throughout Suisun Marsh, the Delta, and upstream tributaries by installing positive barrier fish screens on currently unscreened water diversions.
- Reduce adverse effects of hatchery production on the genetics and population dynamics of Chinook salmon, steelhead, and potentially other fish species throughout the Delta by modifying hatchery production and management practices.
- Increase the availability of tidally influenced subtidal and intertidal aquatic habitat to benefit fish and macroinvertebrates and increase organic carbon, phytoplankton, and zooplankton productions within the Delta and Suisun Marsh through managed breaches flooding selected Delta islands and portions of Suisun Marsh to increase habitat for fish and wildlife.
- Reduce the rate of peat soil subsidence on selected Delta islands, increase production of tules and other vegetation for carbon sequestration, and increase habitat conditions for wildlife by modifying land use and water management to convert islands from conventional agricultural practices and crops to the production of wetland vegetation.
- Increase habitat diversity and complexity and potentially reduce the abundance or geographic distribution on non-native fish and macroinvertebrates within the western and central regions of the Delta by implementing a variable salinity regime to provide additional habitat variability and diversity ranging from the managed freshwater delta as under current conditions or increasing salinity intrusion further upstream into the Delta. Based on the alternative conveyance facilities the ability to implement variable salinity regimes as a habitat enhancement opportunity are constrained to the greatest degree under Option 1, provide opportunities for increased salinity variability under Options 2 and 3, and provide the greatest variability for salinity management (based solely on water quality at the SWP and CVP export facilities) under conveyance Option 4.

- Increase the production of organic carbon, phytoplankton, and/or zooplankton that can subsequently be used to supplement food availability within the Delta food web for a wide variety of aquatic species by managing selected Delta islands for the purpose of producing food supplies that would be discharged into the Delta to augment the food web.

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